SOLUTIA Solutions for a better life.

April 6th, 2010

Dr. Leah Evison
U.S. EPA – Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

RE: Sauget Area 1 Completion Report

Dear Leah:

Attached, please find a hard copy and CD of the March 2010 Sauget Area 1 Dead Creek, Time Critical Removal Action Completion Report which you approved on March 26th, 2010. Also included are 5 additional CD copies of the full report.

This document includes the red-line changes requested by the EPA (and transmitted to you on December 3, 2009), as well as the additional language requested in the March 26th, 2010 approval email.

Any questions, please advise.

Sincerely,

Steven D. Smith
Project Coordinator

cc: Paul Lake – 2 hard copies with CDs
Lisa Cundiff – 1 CD

DEAD CREEK TIME CRITICAL REMOVAL ACTION

FINAL COMPLETION REPORT

SAUGET AREA 1
SAUGET AND CAHOKIA, ILLINOIS

Submitted to:

Solutia Inc.
500 Monsanto Drive
Sauget, Illinois 62206

Submitted by:

Golder Associates Inc.
820 South Main Street, Suite 100
St. Charles, Missouri 63301

March 2010 083-84127

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The United States Environmental Protection Agency (USEPA) issued a *Unilateral Administrative Order* (UAO) to Pharmacia Corporation (f/k/a Monsanto Company) and Solutia Inc. (Docket No. V-W-99-C-554) on June 21, 1999. One of the requirements of the order was the replacement of culverts in Dead Creek to mitigate potential flooding along the creek. The Order required a Time Critical Removal Action in Dead Creek in order to abate a potential imminent and substantial endangerment to public health, welfare, or the environment. Dead Creek is part of the Sauget Area 1 Superfund Sites and is located in the Villages of Sauget and Cahokia, St. Clair County, Illinois. The UAO was subsequently supplemented and modified on May 31, 2000 and August 29, 2001. Pharmacia Corporation and Solutia Inc. (hereinafter referred to collectively as “Solutia”) have undertaken the work required by the UAO.

The response to the UAO included replacement of two culverts in Dead Creek to mitigate the potential flooding and sediment and creek bottom soil removal from Dead Creek, Site M (which was hydraulically connected to Dead Creek) and the basin area located at the lift station adjacent to Prairie du Pont Creek. Other requirements of the UAO included design and construction of a Toxic Substances Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA)-compliant Containment Cell, placement of the excavated materials in the Containment Cell, preparation of a storm water management plan for Dead Creek, and post-excavation sampling to confirm removal completion.

Dead Creek is approximately 17,000 feet long and is divided into six segments as described below (see Figure 1):

- Segment A is approximately 1,800 feet long and located between the Alton and Southern Railroad and Queeny Avenue. This segment was previously remediated by Cerro Copper in 1990 and 1991. The remedial effort included the removal of approximately 27,500 tons of impacted sediment, installation of a high-density polyethylene (HDPE) vapor barrier and filling and covering this segment of Dead Creek with soil and crushed gravel. No further action is planned for Segment A following the 1990-1991 remediation effort.

- Segment B is approximately 2,000 feet long and is located between Queeny Avenue and Judith Lane (discussed further in Sections 4.1.1, 4.1.2, 4.1.3, 4.1.5, 4.1.6, 4.1.7 and 5.0).

- Segment C is approximately 1,200 feet long and is located between Judith Lane and Cahokia Street (discussed further in Sections 4.1.1, 4.1.2 and 4.4).

- Segment D is approximately 1,100 feet long and is located between Cahokia Street and Jerome Lane (discussed further in Sections 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.6, 4.1.7 and 4.4).

- Segment E is approximately 4,000 feet long and is located between Jerome Lane and Illinois Route 157 (discussed further in Sections 4.1.1, 4.1.2, 4.1.7 and 4.4).

- Segment F is approximately 8,700 feet long and is located between Illinois Route 157 and the Old Prairie du Pont Creek (discussed further in Sections 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.6, 4.1.7, 4.3 and 4.4).

- Borrow Pit Lake (BPL) is the discharge area for Dead Creek and is located east of the flood protection levee along the Mississippi River. BPL is approximately one mile long and averages approximately 500 feet wide.

UAO response activities were performed between 1999 and 2008 and are described herein. The scope of work performed during each event was approved by USEPA and field work was overseen and inspected by the USEPA on-Scene Coordinator and consultants working for USEPA, and during later phases of the work, by the Remedial Project Manager for the Site. This report summarizes the removal activities required by the UAO in Sauget Area 1 and Dead Creek and undertaken by Solutia beginning in 1999. Copies of reports and results from each activity are presented in the Appendices.

2.0 CULVERT REPLACEMENT

One of the requirements of the modified UAO, was the replacement of two culverts located in Creek Segment F. The first of these culverts is located on Cargill Elevator Road in Cahokia and originally consisted of one 48-inch diameter corrugated metal pipe (CMP) tube. Two additional 48-inch diameter CMP tubes were constructed at this location. The second culvert is located approximately 250 feet downstream of Cargill Elevator Road, where Dead Creek flows under an abandoned Terminal Railroad (TRRL) line, and consisted of one 54-inch pipe. This line was replaced by three 6 feet x 6 feet concrete box culverts.

Initial design work for the culvert replacement was submitted to USEPA on October 19, 1999. Difficulties arose with the entities who owned the culverts to be replaced, slowing access as well as design work. Replacement culvert designs were ultimately approved by the USEPA in May 2000 and a plan for construction of the culvert under the TRRL was prepared and approved by the USEPA. The detailed plan was necessitated by the fact that the new culvert was to be constructed under three natural gas pipelines that run within the TRRL right-of-way and the pipeline owners raised a number of concerns relating to the stability of the lines during construction. A copy of that Construction Plan is included as Appendix A.

The installation of the two additional 48-unch culverts under Cargill Elevator Road was completed in July 2000. Construction of the culverts under the TRRL embankment was completed in October 2000.

3.0 TSCA CONTAINMENT CELL CONSTRUCTION

The RCRA- and TSCA-compliant on-site double-lined Containment Cell (Containment Cell) was constructed adjacent to the west bank of Dead Creek Segment B, north of Judith Lane in 2001. The Containment Cell was constructed to hold the sediment removed during the Dead Creek Sediment and Soil Time Critical Removal Action. The cell was designed after evaluation of risks associated with shallow groundwater, groundwater usage, leachate migration, flooding and storm water control. Design specifications pertaining to the identified risks were specifically addressed in the Time Critical Removal Action Work Plan (approved April 2001) and the design was approved for construction by the USEPA, with concurrence from the Illinois Environmental Protection Agency (IEPA). By March 2006, approximately 58,300 cubic yards of impacted sediments and soil from Dead Creek were placed in the Containment Cell and a temporary cover was installed. Documentation and Construction Quality Assurance (CQA) information related to the TSCA Containment Cell construction are provided in Appendix B.

3.1 Subgrade and Earthworks

Prior to construction of the Containment Cell, the site was cleared and grubbed and topsoil removed. The Containment Cell footprint was then graded to mirror the intended bottom grades for the lining system. The cell was constructed to drain from a high of approximately elevation 405 feet above mean sea level (feet msl) in the southeast quadrant of the cell to a low of approximately 395.5 feet msl at the northwest corner of the cell. Berms were constructed to a height of approximately 18 feet above the bottom grade, with internal slopes of 3 horizontal to 1 vertical (3H:1V) and external slopes of 4:1. The upper foot of subgrade and all of the earthen berm materials were compacted to at least 95 percent (%) of Standard Proctor maximum dry density, including native soils and imported clean fill.

3.2 Lining Systems, Leachate Detection and Leachate Collection Systems

The Containment Cell is constructed with a double-layer lining system. Lining systems for the cell bottom and cell slopes are described in the following sections.

3.2.1 Bottom Lining System

The bottom of the Containment Cell was constructed with a lining system including dual collection layers and dual liners. The bottom of the system is constructed on a three-foot thick permeable capillary barrier drain sloped to a collection sump. The layers of the bottom lining system, from bottom to top, are described below.

Gravel (capillary break layer). The capillary break layer consisted of 36 inches of gravel placed on the prepared subgrade. Gravel was required to conform to an American Society of Testing Materials (ASTM) C 33 gradation for coarse aggregates, and was compacted by the operation of construction equipment. Three-inch diameter riprap was used as fill and as the first foot of the capillary layer.

Non-woven geotextile. A non-woven, 16-ounce per square yard (oz./sq. yd.) geotextile was placed above the capillary break layer.

Tracked in place soil. A six-inch layer of native soil fill was placed above the geotextile. Soil fill was tracked in place to a compaction at least 90% of Standard Proctor maximum dry density, at or near optimum moisture content. The finished surface was not allowed to have ruts or sharp edges.

Geosynthetic clay lining. A geosynthetic clay lining (GCL), consisting of sodium bentonite between geotextile layers, was installed above the tracked in place soil. The GCL was installed with minimum six-inch overlapping seams, with granular bentonite placed in the overlapping seams.

Secondary HDPE geomembrane. A textured 60 mil high density polyethylene (HDPE) liner was installed above the GCL. This HDPE liner serves as the secondary lining system. Panels were heat seamed to form a continuous barrier. All seams were pressure or vacuum tested to verify integrity. Test samples of welds were collected for destructive sampling. All defects and sample locations were repaired per the specifications.

Geonet. A geonet synthetic drainage layer was installed above the secondary lining. This layer serves as the leachate detection layer. The geonet was at least 200 mils in thickness, with a transmissivity of at least 1.0 square centimeters per second (cm^2/sec). The geonet was overlapped at least four inches on downslope seams and at least 12 inches on transverse seams, and was tied with plastic ties every 12 inches.

Non-woven geotextile. A non-woven, 16 oz./sq. yd. geotextile was placed above the geonet to provide protection of the geonet during placement of the overlying soil.

Tracked in place soil. A 12-inch layer of native soil fill was placed above the geotextile. Fill was compacted to at least 90% of Standard Proctor maximum dry density, at or near optimum moisture content. The finished surface was not allowed to have ruts or sharp edges.

Primary HDPE geomembrane. A smooth 60 mil HDPE liner was installed above the tracked in place soil fill. This HDPE liner serves as the primary lining system. Panels were heat seamed to form a continuous barrier. All seams were pressure or vacuum tested to verify integrity. Test samples of welds were collected for destructive sampling. All defects and sample locations were repaired per the specifications.

Geonet. A geonet synthetic drainage layer was installed above the primary lining. This layer serves as the primary leachate collection layer. The geonet was at least 200 mils in thickness, with a transmissivity of at least 1.0 square centimeters per second (cm^2/sec). The geonet was overlapped at least four inches on downslope seams and at least 12 inches on transverse seams, and was tied with plastic ties every 12 inches.

Non-woven geotextile. A non-woven, 16 oz./sq. yd. geotextile was placed above the geonet, forming part of the primary leachate collection layer.

Sand layer. At least 18 inches of sand were placed above the primary leachate collection layer, forming part of the primary leachate collection layer and preventing intrusion of overlying soils into the system. This sand had a minimum hydraulic conductivity of 1×10^{-3} centimeters per second (cm/sec) and was not compacted. Rounded pea gravel was installed around the perimeter of the cell bottom.

Placed, dewatered sediments. A layer of at least six inches of selected sediments, which did not include sharp or other deleterious materials, was tracked in place above the sand layer.

3.2.2 Slope Lining System

The side slope of the Containment Cell was constructed with a lining system including dual collection layers and dual liners. The layers of the side slope lining system, from bottom to top, are described below.

Geosynthetic clay lining. A GCL, consisting of sodium bentonite between geotextile layers, was installed above the compacted soil berm slopes. The GCL was installed with minimum six-inch overlapping seams, with granular bentonite placed in the overlapping seams. Needle-sewn GCL was used to improve internal stability of the GCL.

Secondary HDPE geomembrane. A textured 60 mil HDPE liner was installed above the GCL. This HDPE liner serves as the secondary lining system. Panels were heat seamed to form a continuous barrier and all seams were pressure or vacuum tested to verify integrity. Test samples of welds were collected for destructive sampling and all defects and sample locations were repaired per the specifications.

Geonet. A geonet synthetic drainage layer was installed above the secondary lining. This layer serves as the secondary leachate collection layer. The geonet was at least 200 mils in thickness, with a transmissivity of at least 1.0 square centimeters per second (cm^2/sec). A hydraulic conductivity of 5 cm/sec was required for the sideslope geonets. The geonet was overlapped at least four inches on downslope seams and at least 12 inches on transverse seams, and was tied with plastic ties every 12 inches.

Primary HDPE geomembrane. A smooth 60 mil HDPE liner was installed above the geonet. This HDPE liner serves as the primary lining system. Panels were heat seamed to form a continuous barrier. All seams were pressure or vacuum tested to verify integrity. Test samples of welds were collected for destructive sampling and all defects and sample locations were repaired per the specifications.

Geonet. A geonet synthetic drainage composite was installed above the primary lining. This layer serves as the primary leachate collection layer. The geonet was at least 200 mils in thickness, with a transmissivity of at least 1.0 square centimeters per second (cm^2/sec). A hydraulic conductivity of 5 cm/sec was required for the sideslope geonets. The geonet was overlapped at least four inches on downslope seams and at least 12 inches on transverse seams, and was tied with plastic ties every 12 inches.

Non-woven geotextile. A non-woven, 16 oz./sq. yd. geotextile was placed above the geonet, forming part of the primary leachate collection layer.

Placed and compacted dewatered sediments. The first two to four feet of sediments placed on the side-slopes were screened to remove materials larger than two inches, sticks, refuse and other sharp objects.

Anchorage. All layers of the lining system from the GCL through the primary leachate collection system were anchored in trenches along the crest of the berms. Anchor trenches were backfilled with compacted soil.

3.2.3 Leachate Collection System

The leachate collection and conveyance system consist of three separate components; a capillary detection system, a primary leachate collection system, and a secondary leak detection system. Each system has a submersible pump, which is water-pressure activated. The capillary layer system discharges into a drainage ditch that discharges to Dead Creek. Water collected in the primary and secondary systems is conveyed to an on-site treatment facility pipe manifold system that combines the separate flows and discharges the combined flow into an HDPE line.

The leachate treatment system consists of an enclosed wastewater treatment facility that houses two holding tanks with a float-activated pump system that receive untreated leachate conveyed via subsurface pipeline from the cell. The leachate is pumped through a high volume sand filter unit. A valve located at the base of the sand filter unit controls the rate of flow to the rest of the treatment system. Following sand filtration, the leachate is pumped through two parallel bag filters, which in turn discharge to primary and secondary carbon adsorption units arranged in a lead/lag configuration. The treated water then passes through a digital flow meter and is discharged to Dead Creek. Current plans call for the treatment system to be replaced by direct discharge of the leachate and contact stormwater to the POTW via the Village of Sauget sewer system. A new sewer line will be installed between the site and the sewer main along Queeny Avenue.

The treatment system is located within an insulated steel building fitted with a 16 x 12-foot roll-up garage door, and is protected from freezing by a thermostatically controlled electric space heater. The whole treatment facility is situated inside a containment basin that consists of a clay liner, overlying polyvinyl chloride (PVC) membrane liner, and a gravel protection layer. A sump located west of the treatment system building collects water from within the containment area and pumps it into the treatment system settling tank, where it mixes with Containment Cell leachate and is treated by the system prior to discharge.

3.3 Temporary Cap

Sediment transfer to the Containment Cell began shortly after USEPA approved the Containment Cell construction. Initial sediment removal and placement were completed by February 2002, with approximately 46,000 cubic yards of sediments from Dead Creek and the lift station sump transferred to the Containment Cell. Following placement of impacted sediment from the Dead Creek excavations in 2002, a temporary cover, consisting of an approximately 12 mil liner manufactured by Raven (Raven Dura Skrim Reinforced linear low density polyethylene [LLDPE]), was placed over the materials to prevent stormwater from infiltrating and leaching through the Containment Cell. The temporary cover is secured by ballasting around the edges of the cell, and by sandbags on top of the liner. A sump was created on the temporary cover in the northwestern corner of the cell and storm water is pumped from the sump by a float activated submersible pump. The storm water is discharged to the ground surface beyond the toe of the cell berm.

Since the containment cell still contained unused air space, use of the temporary cover instead of construction of a final cover allowed the air space to be used for containment of supplemental excavated materials. Additional creek bottom sediments have been added periodically and, by March 2006, approximately 58,300 cubic yards of impacted sediments from Dead Creek had been placed in the Containment Cell. It is anticipated that the rest of the available air space will be used for containment of impacted soils excavated from the W.G. Krummrich Plant. The temporary cover has been maintained and was replaced in its entirety in 2006. The final cover will be installed when the decision is made to close the cell.

4.0 REMOVAL ACTIVITY SUMMARIES

Activities that Solutia has undertaken pursuant to the UAO requirements include installation of a Dead Creek dewatering system (along the entire length of the creek to prepare the sediment for removal), pre-excavation sampling, sediment and soil removal, post-excavation sampling of various creek segments and BPL, installation of a pumping system to improve flow in Dead Creek, and placement of a liner in Dead Creek Segment B. The activities are described in the following subsections.

4.1 Dead Creek Sampling and Sediment and Soil Removal 1999 through 2008 (Multiple Phases)

As a condition of the UAO issued by the USEPA on May 31, 2000, the *Dead Creek Sediment and Soil Time Critical Action Work Plan* was prepared and implemented to excavate sediments from Segments B, C, D, and E. The UAO was amended on August 29, 2001 to include Creek Segment F. The multiple phases of the creek sediment and soil removal actions and associated sampling are summarized in sequential order in the following sections.

4.1.1 Excavation 2001-2002, Dead Creek Segments B, C, D, E, and F

Per the January 19, 1999 *Administrative Order on Consent and Scope of Work (AOC/SOW),* the *Sauget Area 1 Engineering Evaluation/Cost Analysis (EE/CA) and Remedial Investigation/Feasibility Study (RI/FS) Support Sampling Plan* was developed to define the impacted areas of Dead Creek beyond the data gathered from previous site investigations. The results of this sampling effort are presented in the draft *Sauget Area 1 Remedial Investigation Report*. Based on the results of this sampling, the USEPA issued a Unilateral Administrative Order which supplemented the culvert UAO, issued a year earlier, requiring the removal of impacted sediments from Dead Creek. The Time-Critical Removal Action Work Plan was submitted on June 30, 2000 as the first action required under the May 31, 2000 UAO. Command post construction and installation of a sediment dewatering system began in November of 2000 with the installation of the sediment dewatering system completed in January 2001. Approximately 46,000 cubic yards of impacted sediment were removed from Segments B, C, D, E, and F by February 2002. The excavated sediment was transported to the on-site RCRA and TSCA-compliant Containment Cell for disposal. A temporary cover was placed over the sediment within the Containment Cell. Sediment removal from all of the segments was performed in a manner designed to reduce impact to natural vegetation.

Following the removal of sediment from Dead Creek, a 60 mil plastic membrane was placed in the northern 500 feet of the channel in creek sector B and a non-woven geotextile was installed in the remainder of the channel in this sector as a temporary measure.

4.1.2 Post-Excavation Sampling 2001-2002, Dead Creek Segments B, C, D, E and F

Following the initial Dead Creek Sediment Removal Action, post-excavation sampling and analyses of creek bottom sediment were performed. The sampling event indicated that creek bottom soils containing concentrations of several constituents potentially resulting in adverse ecological impacts remained in some areas of the creek. Sediment samples were collected from Creek Segments B, C, D, E, and F. The samples were analyzed for metals (arsenic, barium, chromium, copper, lead, nickel, selenium, and silver) by Method 6010B, mercury by Method 7470/7471, cyanide by Method 9010B, volatile organic compounds by Method 8260B, semivolatile organic compounds by Method 8270C, polychlorinated biphenyls (PCBs) by Method 8082, organochlorine pesticides by Method 8081A, chlorinated herbicides by Method 8151A and dioxin by Method 8280A. The results of these analyses were screened against the following site specific risk based concentrations (RBCs):

Analyte		**RBC (mg/kg)**
SVOCs	Bis(2-ethylhexyl)phthalate	0.478
Pesticides	gamma-Chlordane	16.6
	Total DDT	4.1
	Dieldrin	4.75
Total PCBs		0.58
Dioxin TEQ		0.0005
Metals	Chromium	261
	Copper	24,792
	Lead	3,150
	Mercury	0.18
	Zinc	4,739

The results of the screening were as follows:

- Soils at three locations in Segment B contained residual PCB concentrations above the RBCs in the northern 700 feet of Segment B between transects T0 and T7, in the middle of Segment B at transect T11, and at the southern end of the segment at transect T17 (see Figure 3-1 in Appendix D).

- Soils in Segment C contained no constituents at concentrations in excess of the RBCs.

- Samples collected in Segment D (see Figure 3-2 in Appendix D) immediately upstream of the Jerome Lane culvert along transect T6 contained PCB and dioxins at levels in excess of the RBCs. Zinc concentrations were measured above the RBCs at other transects throughout Segment D.

- Samples were collected at approximately 400-foot centers along the creek bottom in Segment E (see Figure 3-3 in Appendix D). Zinc concentrations were detected above the RBCs in some samples from Segment E.

- Samples spaced at approximately 400-foot centers along the creek bottom were collected in Segment F (see Figure 3-3 in Appendix D). The results indicated some sample concentrations of zinc above the RBCs in some areas of Segment F.

- Appendix D provides summary tables of the post-excavation sampling results in Segments B, C, D, E and F. Further delineation sampling was performed in subsequent efforts discussed below.

4.1.3 Pre-Excavation Sampling 2004, Dead Creek Segments D and F

Based on results from the removal of sediment from Dead Creek in 2000-2002 and the associated post-excavation sampling, additional sampling of Segments D and F was performed to more accurately define the areas within these segments where additional excavation should be conducted. The results were compared with the 2002 post-excavation sampling in an effort to focus the remedial measures and to better define excavation areas.

The 2002 post-excavation sampling indicated that creek bottom soils in a 200-foot stretch located immediately upstream of the Jerome Lane culvert in Segment D exceeded the RBC for PCBs. The pre-excavation sampling in Segment D in 2004 consisted of collecting 20 soil samples from four locations, spaced 50 feet apart within the 200-foot stretch. At each location, five soil samples were collected at one-foot intervals of depth to a total depth of five feet. Samples were collected using a hand-auger and were analyzed for PCBs (Method 8082). In the four locations sampled, the PCB concentrations were all below the RBC, with analyte detections in only four samples. Immunoassay kits were used to screen split samples for PCBs. One sample collected indicated PCB concentrations within the range of the calibrated immunoassay kit (0.5 mg/kg to 5 mg/kg). This sample correlates with the sample reported by the laboratory to contain the highest PCB concentrations. Although PCBs were detected in this sample, concentrations were below the RBCs. No additional samples were analyzed for dioxins since it was reasonable to assume that the excavation of any soils containing PCBs above the RBC would also effectively remove dioxins.

In 2002, zinc was detected in three creek bottom soil samples (T4, T5 and T6) collected in Segment F. The samples collected at transect T5 contained zinc at concentrations above the RBCs. In 2004, a total of 32 additional locations were sampled in the 800-foot length of Segment F defined in 2002. The 2004 sediment sample locations were spaced approximately 25 feet apart on center between transects T4 and T6 in an effort to further delineate the extent of soil containing zinc concentrations above the RBC. At each location, five samples were collected at one-foot intervals of depth to a total depth of five feet. Samples were collected using a hand-auger and were analyzed for zinc. Zinc concentrations were detected above the RBCs in five of the 160 samples collected from the 0 to 1 foot depth interval. Split samples were also collected and analyzed for zinc using portable x-ray fluorescence (XRF). Appendix E presents a technical memorandum with figures and summary data tables for these activities in Segments D and F.

Based on the results from the 2004 pre-excavation sampling of Segments D and F, the areas where remaining concentrations exceeding the RBCs for PCBs and zinc were better defined. Soils containing PCBs at concentrations greater than the RBCs in Segment D were localized in the surficial layer in an area within 20 feet of transect T6. The 2004 results for zinc in Dead Creek Segment F supplemented the results from 2002, showing impacts in three areas within the shallow soil profile near transect T5.

4.1.4 Pre-Excavation Sampling 2005, Dead Creek Segment B

Pre-excavation sampling of creek bottom soil in Segment B was performed in May 2005 to accurately delineate the extent of exceedences of RBCs in the areas identified in the 2002 sampling. Samples of creek bottom soil were collected and analyzed for PCBs by Method 8082, bis(2-ethylhexyl)phthalate by Method 8270C, zinc by Method 6010B and mercury by Method 7470/7471. Sixty-two additional locations were selected and sampled during the 2005 pre-excavation effort, based on the 2002 creek bottom transect sampling results. Samples were collected using either a specialized piston sediment sampler or direct-push methods. Locations in the northern portion of Segment B, where a geotextile layer and crushed gravel had been installed, were hand excavated to the geotextile layer and the geotextile layer was cut prior to sampling. Boreholes were advanced to approximately 5 feet below ground surface (bgs) with samples collected at 1-foot intervals of depth. All of the sample borings were backfilled with bentonite upon completion. Appendix F presents a table summarizing the sampling results and a figure showing sample locations and RBC exceedences.

4.1.5 Creek Bottom Soil Removal 2005, Dead Creek Segments B, D and F

A *Dead Creek Sediment and Soil Removal Action Revised Creek Bottom Soil Removal Work Plan* for further removal of impacted Dead Creek soils was submitted July 27, 2005. This work plan was based on data collected during the 2002, 2004 and 2005 sampling efforts. The areas to be excavated and the excavated volumes were estimated based on these data.

- Excavation of Segment B was conducted in December 2005, with a total of 2,300 cubic yards of soil being removed. The excavated depths in Segment B ranged from 1.5 feet to 6.2 feet.

- In January 2006, Segment D was excavated north and south of Kinder Street. Approximately 841 cubic yards of soil were removed north of Kinder Street to an average depth of 1.6 feet, while approximately 283 cubic yards of soil were excavated south of Kinder Street to an average depth of 1.3 feet. Following confirmation sampling in this segment, a further 180 cubic yards of soil were removed. In an effort to clean up ramp and sediment load-out areas, an additional 77 cubic yards were excavated from Segment D.

- The excavation of Segment F was completed in February 2006 with the removal of approximately 1,328 cubic yards of material. The depth of excavation ranged from 0.8 feet to 1.2 feet.

All excavated soil was transported to the Containment Cell for disposal. Appendix G contains additional information regarding the 2005 soil removal.

4.1.6 Confirmation Sampling 2005, Dead Creek Segments B, D and F

Confirmation soil sampling was performed to establish the excavated areas (Dead Creek Segments B, D and F) no longer contain concentrations of constituents that exceeded their respective RBCs. Samples were analyzed for zinc and mercury (Method 6010/7470), bis(2-ethylhexyl)phthalate (Method 8270), total PCBs (Method 8082) and dioxins (Method 8280). Confirmation sampling was completed at the following locations:

Segment B

- Dioxins: Transects T0, T3, T16 and T17
- Mercury: Transect T1+75C[1], T2+00C and T2+25C
- PCBs and bis(2-ethylhexyl)phthalate: T2+50, T2+75, T3+25 and T3+00

Segment D

- Dioxins: Transect T6
- Zinc Transect T1 through T2

Segment F

- Dioxins: Transect T5
- Mercury: Transects T2, T3, T4, T5, T6, T9 and T14
- Beta-BHC: Transects T2 and T3

Soil samples were collected from the areas of excavation at depths to one foot below the anticipated base of the excavation (based on 2002 sampling results). In most cases, samples were collected at multiple locations and various depths prior to excavation. This methodology was used to determine the appropriate depth for excavation and also provided post excavation residual soil concentrations.

[1] Transect T1+75C refers to a sample located 75 feet downstream of Transect T1 (+75) along the approximate centerline of the channel (C). Samples located along the western and eastern edges of the channel are designated (W) and (E), respectively.

Samples were collected using a stainless steel trowel or hand auger and submitted to an analytical laboratory for testing. The removal based on cut lines indicated that the impacted soil was removed from Segments B, D and F. Appendix H provides a table summarizing the sampling results.

4.1.7 Soil Removal 2006, Dead Creek Segment E

Prior to excavation, creek bottom soil samples were collected upstream and downstream of Segment E transect T16 in an effort to delineate the extent of Dieldrin impacts, to define the depth of excavation, and to determine the post excavation residual concentrations of dieldrin.. A total of approximately 20 to 25 cubic yards of impacted sediment were excavated from the creek and transported to the Containment Cell for disposal. Appendix I provides a table summarizing the sampling results.

4.2 Dead Creek Water Pumping System

The bottom of Dead Creek is below the culvert inverts at many of the road crossings and, as a result, the creek does not flow during low water conditions. At the request of the Village of Cahokia, six submersible solids handling pumps were installed to improve water flow and reduce ponding in Dead Creek Segments B, C, D, and E during dry periods. During excavation of Dead Creek soils in 2005 and 2006, these pumps were used as part of a water diversion system and portions of the creek were re-graded to improve downstream flow. As a result of the re-grading activities, only three of the original six pumps are currently needed to supplement natural flow in the creek. The three remaining submersible pumps are located in Segment C on the south side of Judith Lane, Segment D on the north side of Kinder Street, and in Segment E on the north side of the Parks College parking lot (see Appendix C). The pumps are owned and maintained by the Village of Cahokia, with operating and maintenance expenses being borne by Solutia.

4.3 Borrow Pit Lake Remediation

4.3.1 Pre-excavation Sampling, Borrow Pit Lake

An investigation was performed in BPL to assess the extent of sediments containing mercury at concentrations exceeding the RBCs for fish and fish eating birds in 2000. Four sediment samples were collected to evaluate impacts from Dead Creek discharges to BPL. The samples were collected at the following locations:

- 3,000 feet upstream of the confluence of Dead Creek and BPL (in Segment F);
- 200 feet upstream of the confluence of Dead Creek and BPL (in Segment F);
- At the mouth of Dead Creek, and
- 200 feet downstream of the confluence of Dead Creek and BPL.

The sediment samples were analyzed for mercury (Method 7470/7471). The highest concentration of mercury was measured at the mouth of Dead Creek. The other three samples did not indicate mercury in exceedance of the RBC. In addition to the 2000 BPL mercury sampling, post-excavation sampling of Dead Creek Segment F was performed in 2002. Fifteen samples were collected from Dead Creek bottom sediment spaced at approximately 400-foot centers. The results from both sampling events were compared with the Threshold Effects Concentrations (TEC) presented in the USEPA Sediment Quality Guidelines. The TEC is the value at which mercury concentrations are considered to pose an ecological food chain risk. The sediment sample collected from the mouth of Dead Creek was above the TEC (0.18 milligrams per kilogram [mg/kg]), suggesting additional sampling should be performed.

In May 2003, surface and subsurface sediment samples were collected from BPL to further characterize the extent of mercury impacts in the BPL. Surface samples were collected to a depth of six inches and subsurface samples were collected from six inches to the bottom of the sediment layer. Sample locations were selected based on a grid pattern and a total of sixty surface samples were collected, one from the center of each grid square. Thirty subsurface samples were also collected; one from the center of the odd grid squares, using Lexan drive-tubes. Appendix J provides a table summarizing the sampling results and figures indicating the sampling locations.

4.3.2 Sediment Removal 2005, Borrow Pit Lake

The extent of the required excavation was determined from previous sampling events in which the mercury concentrations throughout BPL were characterized (see Appendix J). Excavation of impacted BPL sediment was completed in February 2006, during which a total of 6,500 cubic yards of material was excavated. Based on confirmation sampling results, an additional 761 cubic yards of material was excavated from Block #38 and Block #49 in February 2006. An additional 40 cubic yards of material was removed from Block #49 in March 2006, based on further confirmation sampling. Final confirmation sampling results required removal of another 14 cubic yards of material from Block #49 in March 2006. The depth of sediment excavated from the BPL blocks was relatively shallow and ranged from 0.6 feet to 1.3 feet. All excavated sediment was transported to the Containment Cell for disposal.

4.4 Dead Creek Cadmium Soil Leaching Investigation

An investigation to assess cadmium leaching from soil to groundwater in Dead Creek Segments C, D, E, and F was performed during July 2007. Four temporary wells were installed west of Dead Creek on July 9, 2007 in the following locations:

- Transect T7 in Segment C (CSC-T7), temporary well 7;
- Transect T2 in Segment D (CDS-T2), temporary well 2,
- Transect T16 in Segment E (CSE-T16), temporary well 16, and
- Transect T6 in Segment F (CSF-T6), temporary well 6.

Groundwater sampling locations in each Segment were chosen based upon the highest cadmium concentration detected in sediment during previous investigations. Groundwater samples were collected from the four temporary wells.

Four soil boreholes were advanced with a Geoprobe™ 6610 series track-mounted rig using direct-push methods. The boreholes were advanced to approximately five feet below the water table, with soil samples collected at four-foot intervals. Temporary wells were installed in each of the boreholes and groundwater samples were collected. Two of the temporary wells were offset due to inaccessibility to the crest of the bank of Dead Creek. MW-T6 was offset 150 feet west and MW-T16 was offset 50 feet west. The groundwater samples consisted of two filtered (10-micron and 0.45-

micron filters) and one unfiltered sample collected from each temporary well location to measure the colloidal, dissolved and total cadmium concentrations (SW-846 Method 3550/6020), respectively.

The results indicated no significant difference between filtered and unfiltered cadmium concentrations in the samples. The cadmium concentrations reported for MW-T7 (Creek Segment C) and MW-T2 (Creek Segment D) indicated that the cadmium was primarily dissolved in the groundwater. The cadmium concentrations reported for the MW-T16 (Creek Segment E) samples indicated the cadmium is primarily associated with colloidal sized material. Results for MW-T6 (Creek Segment F) showed cadmium detected only in the unfiltered sample. This result is representative of cadmium concentrations associated with particulate matter suspended in the sample and not in the dissolved fraction. The groundwater cadmium concentrations (unfiltered and filtered) measured from all four segments were below the Illinois Class I groundwater protection standard of 0.005 milligrams per liter (mg/L). The results of the investigation demonstrated that cadmium concentrations in soil are not significantly leaching to groundwater. The final report with tables and figures is provided in Appendix K. This report was approved by the USEPA on January 24, 2008.

5.0 CREEK SEGMENT B LINER CONSTRUCTION

The approved Time Critical Removal Work Plan requires the construction of a liner and protective cover system in CS-B. This requirement was predicated on the assumption that the initial sediment removal completed in 2002 would leave residual constituent concentrations of concern. It was also considered a precaution, to protect against the unlikely scenario where potential leaching from the disposal areas in the northern portion of CS-B (Sites G, H, and L) in the future could result in ongoing releases to the creek.

Most of the Creel Segment B liner construction (about 80%) was completed in 2007, but final construction was delayed first by freezing weather and then by record precipitation through much of 2008. Final liner construction was completed late in 2008. Appendix L includes construction documentation for Creek Segment B liner construction, including preconstruction and conformance testing of liner, earthworks, and other construction materials, design drawings, and construction reports through January 2008.

5.1 Creek Segment B Liner Installation, September 2007 – January 2008

Beginning in September 2007, a liner and protective cover system were installed in Segment B. Prior to commencing installation of the liner system, Segment B was cleared and grubbed, and the sections of temporary liner and geotextile installed in 2002 were removed and stockpiled under a temporary cover pending disposal. The layers of the Segment B lining system, from bottom to top, are described below.

Subgrade sediment or compacted fill. Existing material was cut and filled to provide the required bottom grade and side slopes. An additional 3,633 cubic yards of clay were imported to complete the grading. The contractor tracked the clay in place and compacted it with a sheepsfoot compactor. Side slope grades varied, primarily based on property lines and easement boundaries. In general, slopes were graded at 2 horizontal to 1 vertical (2H:1V) at the south (Judith Lane) and north (Queeny Avenue) ends of Segment B; the intervening section of the west embankment was graded at approximately 3H:1V; and the east embankment was graded to transition from approximately 2H:1V in the northern section to approximately 4H:1V in most of the remaining length. Subgrade preparation, which began at Queeny Avenue and worked downstream, was completed to within about

300 feet of Judith lane (Station 103+00) by the time that work was halted in early February 2008 because of freezing weather.

Non-woven geotextile. The Segment B liner was designed to include non-woven, 8 oz./sq. yd. geotextile to be placed along the entire length of Segment B, immediately above the subgrade. A total of approximately 150,996 square feet (sq. ft.) of geotextile was placed before work was suspended in early February 2008. At that time, installation was completed to approximately Station 103+00.

HDPE Liner. The Segment B liner was designed to include a 60 mil HDPE liner to be placed under the length of Segment B. A total of approximately 149,541 sq. ft. of 60 mil HDPE was placed before work was suspended in February 2008. Installation was completed to approximately Station 103+00 by that time.

Non-woven geotextile. The Segment B liner system includes two layers of non-woven, 16-oz./sq. yd. geotextile to be placed over the HDPE liner along the entire the length of Segment B. A total of approximately 297,080 sq. ft. of 16 oz./sq. yd. nonwoven geotextile was placed before work was suspended in February 2008. Installation was completed to approximately Station 103+00 at that time.

Anchorage of liner systems. The non-woven geotextile layers and HDPE liner were anchored using two methods, depending upon the uppermost lining element to be employed in the creek:

- Where the uppermost lining element was to be riprap, the geotextile and HDPE liners were anchored in trenches along the crest of the creek bank. The anchor trenches were then backfilled with compacted soil.

- Where the uppermost lining element was to be articulated concrete block (ACB), the geotextile and HDPE liners were anchored to a batten strip installed on the ACB deadman anchor.

Anchor trenches were completed to about Station 103+00 before work was suspended in February 2008.

Bedding stone. The liner system is covered by a 6-inch thick layer of protective bedding stone placed along the entire length of Segment B. The bedding stone is immediately above the 16 oz./sq. yd. geotextile and installation was completed to approximately Station 103+00 before work was suspended.

Riprap. A one-foot thick layer of approximately four-inch to six-inch riprap was placed above the bedding stone across the entire width of the Creek from the Judith Lane culvert to a point approximately 60 feet upstream of the culvert (Station 100+60), and from approximately Station 101+40 to Station 116+50. By the time that work was temporarily halted in early February 2008, riprap had been placed in the bottom and on the west bank of the creek from approximately Station 104+00 to 115+25.

Articulated concrete block (ACB). In places where the side slopes were too steep to support riprap placement, ACB was placed on top of the bedding stone. These areas consisted of a section in the upstream portion of the creek between Queeny Avenue and a point approximately 290 feet downstream (Station 119+40 to Station 116+50) and a section north of Judith lane between Stations 100+60 and 101+40.

Anchorage for the ACB consisted of reinforced 3,000 pound per square inch (psi) concrete deadmen with integrated attachment loops of #4 reinforcing steel. The ACB was anchored to the steel loops with wire reinforced polyester rope ties. The reinforcing bar loops and the ties between the ACB and deadmen were grouted with one foot of 3,000 psi grout. The remainder of the anchor trenches was filled with compacted gravel, flowable fill, or compacted clay.

In February 2008, liner installation activities were temporarily discontinued due to freezing weather. Record precipitation throughout most of 2008 allowed only intermittent work, and prevented completion of the lining until December 2008.

5.2 Completion of Creek Segment B Liner Installation, 2008

The Segment B liner installation was completed in intermittent periods from April through December 2008. Construction information, provided by URS, is included in Appendix M. In order to allow completion of construction, a drainage pipe wrapped in geotextile and a layer of drainage gravel were installed beneath the southern creek bed from Judith Lane to about Station 102+50 prior to completing work at the south end of the site. Activities conducted from April through December 2008 are described below. Design details are as described in Section 5.1, and as presented in Appendix L.

Subgrade sediment or compacted fill. Some regrading and final grading were required before work resumed at the south end of the site in October 2008. In addition, final grading was conducted along all anchor trenches.

Non-woven geotextile. An additional approximately 25,000 sq. ft. of 8 oz./sq. yd. nonwoven geotextile was placed in two layers from the Judith Lane culvert to approximately Station 103+00.

HDPE Liner. An additional approximately 24,434 sq. ft. of 60 mil HDPE was placed from the Judith Lane culvert to approximately Station 103+00.

Non-woven geotextile. An additional approximately 52,000 sq. ft. of 16 oz./sq. yd. nonwoven geotextile was placed from the Judith Lane culvert to approximately Station 103+00. All layers of geotextile and HDPE were tied into anchor trenches along the east and west banks of the creek. Anchor trenches were backfilled with compacted fill.

Anchorage of liner systems. Installation of anchor trenches south of approximately Station 103+00 was completed in late 2008.

Bedding stone. Installation of bedding stone was completed from Judith Lane to approximately Station 103+00. A total of approximately 4,969 tons of bedding stone were placed in Segment B.

Riprap. Riprap (approximately four-inch to six-inch) was installed on the bottom and west bank of the creek from approximately Station 115+25 to 116+50. Riprap was also installed along the east slope from Station 101+40 to 116+50, on the bottom and west bank of the creek from approximately Station 101+40 to 104+00, and from the Judith Lane culvert to approximately Station 100+60. A total of approximately 7,400 tons of riprap were placed in Segment B.

Articulated concrete block (ACB). ACB was installed from approximately Station 100+60 to 101+40. The ACB was anchored to batten strips attached to the continuous, reinforced concrete deadmen installed along the embankments in January and February 2008. Joints in all of the ACB, as well as the headwall at Queeny Avenue, were grouted with 4,000 psi grout. The ties between the ACB and deadmen at the south end of the site were grouted with flowable fill, and the remainder of the anchor trenches was filled with compacted gravel. The ACB surface was finished with Illinois Coarse Aggregate 6 (CA-6) gravel to level the surface of the ACB.

6.0 TSCA CONTAINMENT CELL – MAINTENANCE AND GROUNDWATER MONITORING

Inspection and maintenance of the TSCA Containment Cell have been conducted since its completion. A groundwater monitoring system has been installed and quarterly monitoring has been conducted since 2001.

6.1 Inspection and Maintenance Plan – Temporary Cover and Appurtenant Structures

Post-closure inspection and monitoring of the temporary landfill cover, leachate collection and conveyance systems, leachate treatment system, and general site conditions have been performed since construction and have continued through the present. Periodic inspections have been conducted, with any issues or damage reported and minor repairs completed. The *Inspection and Maintenance Plan* for the TSCA Containment Cell also includes an Influent/Effluent Sampling Program. The leachate treatment system is routinely inspected and maintained as part of the maintenance plan. Treatment system influent and effluent are sampled quarterly for VOCs (Method 624), SVOCs (Method 625), PCBs (Method 680), and metals (Method 200.7).

6.2 Groundwater Monitoring Plan

A groundwater monitoring system was installed to monitor groundwater quality in the vicinity of the TSCA Containment Cell. The monitoring system is comprised of ten wells including (see Appendix N):

- Three wells upgradient to the east of the Containment Cell (TCMW-2 and the well pair TCMW-3S and TCMW-3M);
- Two wells upgradient approximately 1,000 feet east of the Containment Cell (the well pair TCMW-1S and TCMW-1M);
- Three wells downgradient to the west of the Containment Cell (TCMW-4 and the well pair TCMW-5S and TCMW-5M); and
- Two wells downgradient approximately 600 feet west of the Containment Cell (the well pair TCMW-6S and TCMW-6M).

As noted, four of the well locations are nested well pairs with one shallow well screened to a depth of approximately 25 feet bgs and one deeper well screened to a depth of approximately 50 feet bgs. Quarterly sampling of groundwater from these wells has been performed and samples analyzed for VOCs (Method 8260), SVOCs (Method 8270), PCBs (Method 680), and metals (Method 6010).

7.0 SIGNATURES

Please contact us if you have any questions regarding this work or require additional information.

Sincerely,

GOLDER ASSOCIATES INC.

Amanda W. Gilbertson, Ph.D.
Project Environmental Engineer

Mark Haddock, R.G., P.E.
Senior Engineer
Associate

8.0 REFERENCES

Golder Associates Inc., *Draft Inspection and Maintenance Plan, Temporary Cover and Appurtenant Structures*, Sauget Area 1 TSCA Containment Cell, Sauget, Illinois, dated October 2005.

Golder Associates Inc., *Dead Creek Soil-Groundwater Leaching Investigation*, Sauget Area 1, Sauget and Cahokia, Illinois, dated December 2007.

Solutia Inc., 1999. *Sauget Area 1 EE/CA and RI/FS Support Sampling Plan*, Sauget Area 1, Sauget and Cahokia, Illinois, dated April 9, 1999.

Solutia Inc., 2001. *Dead Creek Sediment and Soil Time Critical Removal Action Work Plan*, Sauget Area 1, Sauget and Cahokia, Illinois, dated April 2001.

Solutia Inc., 2001. *Draft Operations and Maintenance Plan*, Sauget Site Area 1 TSCA Landfill, Sauget and Cahokia, Illinois, dated April 10, 2001.

Solutia Inc., 2001. *Construction Quality Assurance, Construction Through Primary Liner System*, Sauget Area 1 TSCA Containment Cell, Sauget and Cahokia, Illinois, dated September 2001.

Solutia Inc., 2001. *Draft Sauget Area 1 Remedial Investigation Report*, Sauget and Cahokia, Illinois.

Solutia Inc., 2002. *Dead Creek Sediment Removal Action Mitigation Plan*, Sauget Area 1, Sauget and Cahokia, Illinois, dated October 4, 2002.

Solutia Inc., 2005. *Sauget Area 1 Time Critical Sediment Removal Action Revised Creek Bottom Soil Removal Work Plan, Dead Creek Segments B, D and F*, Sauget Area 1, Sauget and Cahokia, Illinois, dated July 27, 2005.

United States Environmental Protection Agency, 1999. *Administrative Order on Consent and Scope of Work*, Sauget Area 1, Sauget and Cahokia, Illinois, January 19, 1999.

United States Environmental Protection Agency, 1999. *Unilateral Administrative Order*, Docket No. V-W-C-99, Sauget Area 1, Sauget and Cahokia, Illinois, June 21, 1999.

United States Environmental Protection Agency, 2000, *Unilateral Administrative Order*, Docket No. V-W-C-99, Sauget Area 1, Sauget and Cahokia, Illinois, May 31,2000.

United States Environmental Protection Agency, 2001 *Amended Unilateral Administrative Order*, Docket No. V-W-C-99, Sauget Area 1, Sauget and Cahokia, Illinois, August 29, 2001.

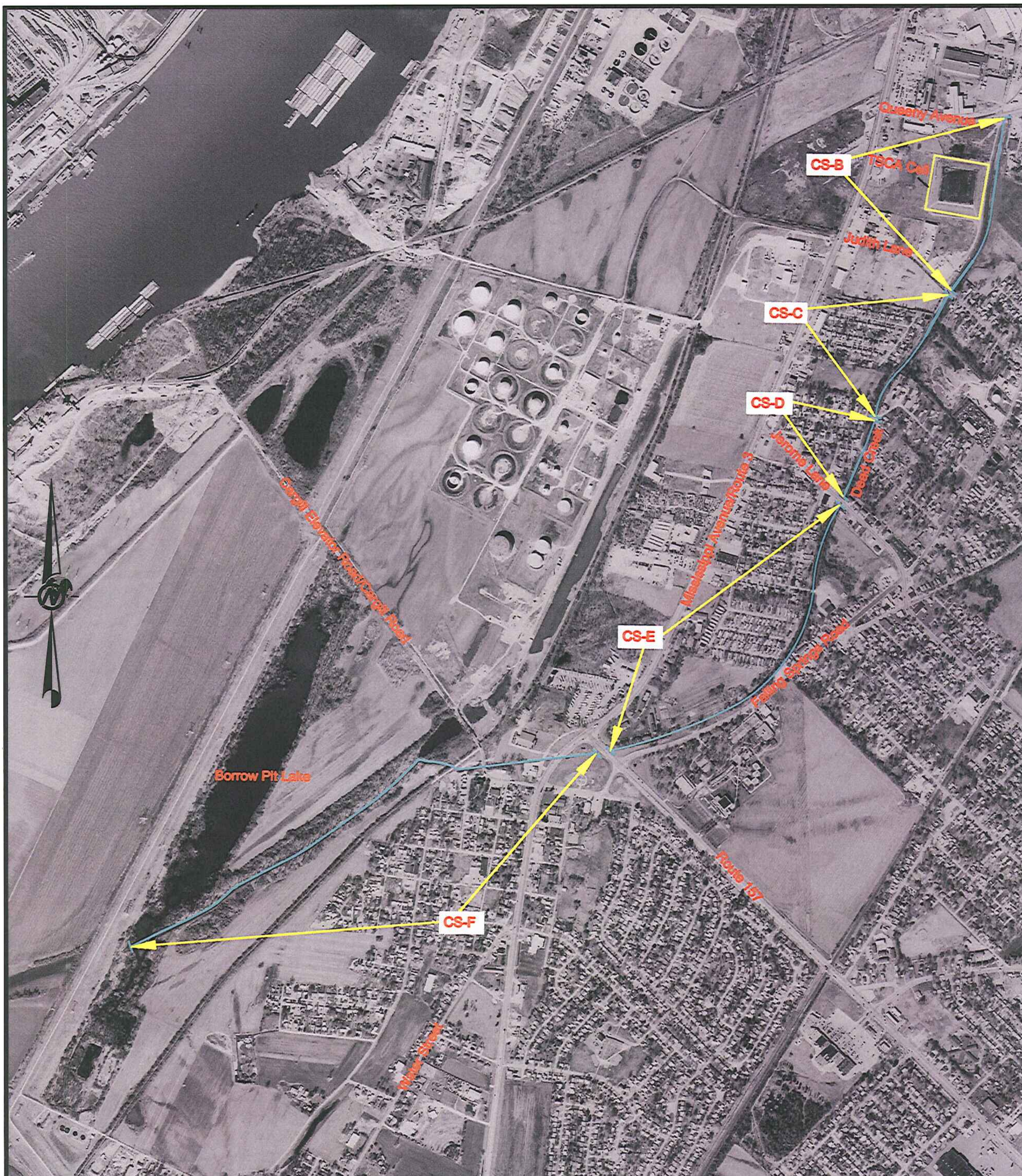
Solutia Inc., 2005. *Sauget Area 1 Time Critical Sediment Removal Action Revised Creek Bottom Soil Removal Work Plan, Dead Creek Segments F and Borrow Pit Lake*, Sauget Area 1, Sauget and Cahokia, Illinois, dated November 11, 2005.

Solutia Inc., 2005. *Draft Sauget Area 1 Time Critical Sediment Removal Action Soil and Sediment Removal Work Plan Dead Creek Segment F and Borrow Pit Lake*, Sauget and Cahokia, Illinois, dated December 8, 2005.

URS Corporation, 2007. *Draft Area 1 – Dead Creek Excavation, Transfer and Placement of Creek Bottom Soils Completion Report*, Sauget and Cahokia, Illinois, dated March 3, 2007.

URS Corporation, 2007-2008. Construction reports, laboratory tests, and drawings for Dead Creek Segment B liner construction, various dates.

FIGURES



0.2 0 0.2 0.4
APPROXIMATE SCALE MILES

Notes:

1.) AERIAL PHOTO FROM TOPOZONE, 2007

Legend:

CS-F CREEK SEGMENT (CS-B through CS-F)

PROJECT No.	043-9870
FILE No.	0439870.001
REV. 1	SCALE AS SHOWN
DESIGN MNH	02/22/08
CADD AWG	03/10/09
CHECK MNH	03/10/09
REVIEW MNH	03/10/09
FIGURE 1	

TITLE

CREEK SEGMENT LOCATION MAP

PROJECT

DEAD CREEK REMEDIATION
SUMMARY OF WORK COMPLETED
SAUGET AREA 1
Sauget and Cahokia, Illinois

Golder Associates
St. Louis, Missouri

APPENDICES